

## Program Analyzes Spacecraft/Ground Radio Links

NASA's Jet Propulsion Laboratory, Pasadena, California

A versatile computer program analyzes the link-design control table necessary for designing the telecommunication subsystem of a spacecraft in orbit around the Earth or on a deep-space mission. The program helps to calculate all the important parameter values for spacecraft-to-ground telemetry links and ground-to-spacecraft command links. The program also enables the design of turn-around ranging and one-way ranging links, which are very useful for determining the positions of spacecraft and for satisfying various other operational

needs. The user can specify several aspects of spacecraft telecommunication-subsystem design, including the nature of the antenna (paraboloidal reflector, patch, dipole, etc.), the power-amplifier rating, and the link data rate.

The program enables the use of comparative design procedures and includes an extensive database on the capabilities, attributes, and costs of commercially available telecommunications equipment. Hence, the program can also perform cost analyses. The software includes an extensive ground-station

database, so that link design can be carried out using different ground stations in a comparative process in an effort to select the best design. The output of the program is in the form of graphs as well as numbers.

*This program was written by Faiza Lansing and Anil Kantak of Caltech for NASA's Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1).*

*This software is available for commercial licensing. Please contact Karina Edmonds of the California Institute of Technology at (626) 395-2322. Refer to NPO-40442.*

## Two-Way Communication Using RFID Equipment and Techniques

Dynamic data could be exchanged, in addition to conventional static RFID data.

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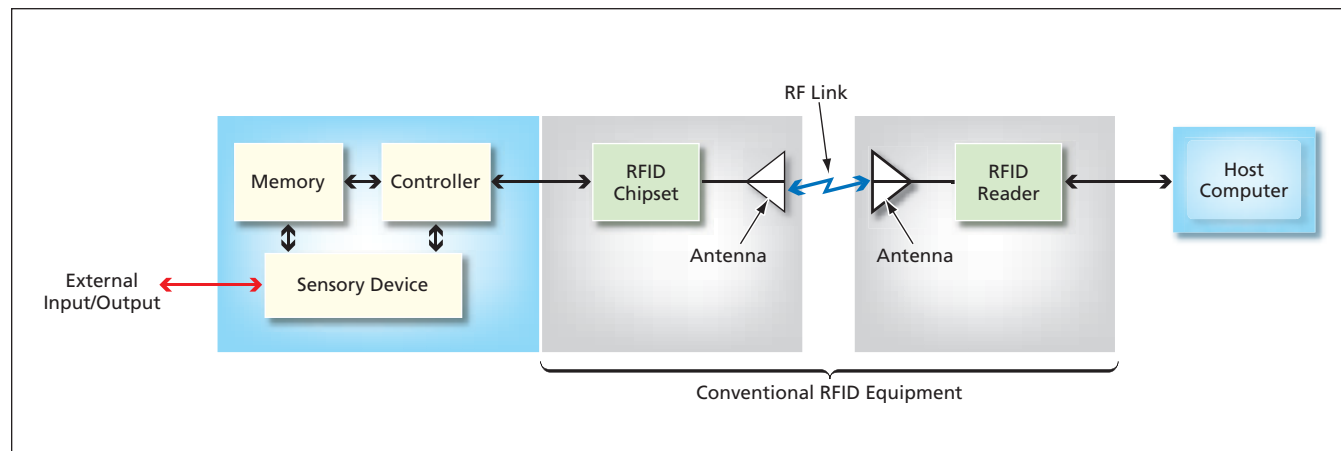
Equipment and techniques used in radio-frequency identification (RFID) would be extended, according to a proposal, to enable short-range, two-way communication between electronic products and host computers. In one example of a typical contemplated application, the purpose of the short-range radio communication would be to transfer image data from a user's digital still or video camera to the user's computer for recording and/or processing. The concept is also applicable to consumer electronic products other than digital cameras (for example, cellular telephones, portable computers, or motion sensors in alarm systems), and to a variety of industrial and scientific sensors and other devices that generate data.

Until now, RFID has been used to exchange small amounts of mostly static information for identifying and tracking assets. Information pertaining to an asset (typically, an object in inventory to be tracked) is contained in miniature electronic circuitry in an RFID tag attached to the object. Conventional RFID equipment and techniques enable a host computer to read data from and, in some cases, to write data to, RFID tags, but they do not enable such additional functions as sending commands to, or retrieving possibly large quantities of dynamic data from, RFID-tagged devices. The proposal would enable such additional functions.

The figure schematically depicts an implementation of the proposal for a

sensory device (e.g., a digital camera) that includes circuitry that converts sensory information to digital data. In addition to the basic sensory device, there would be a controller and a memory that would store the sensor data and/or data from the controller. The device would also be equipped with a conventional RFID chipset and antenna, which would communicate with a host computer via an RFID reader.

The controller would function partly as a communication interface, implementing two-way communication protocols at all levels (including RFID if needed) between the sensory device and the memory and between the host computer and the memory. The controller would perform power



An RFID System Extended as Proposed would enable a host computer to control a sensory device and retrieve data stored in the memory of that device.

management and other tasks essential to operation, and would encrypt data if necessary.

The RFID chipset would handle RFID communications (including implementing RFID protocols in cooperation with the controller). As in ordinary RFID tags, the RFID chipset would accept RF power received via the antenna, convert the RF power to DC power, and distribute the power both within itself and to any other circuitry as needed. The RFID chipset would interact with the controller to pass data from the sen-

sor memory to the host computer and/or to pass commands from the host computer.

The host computer would control the RFID reader. The host computer would contain application software and/or firmware that would enable the user to communicate with the sensory device and process data received from the sensory device.

*This work was done by Thomas Jedry and Eric Archer of Caltech for NASA's Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1).*

*In accordance with Public Law 96-517, the contractor has elected to retain title to this invention. Inquiries concerning rights for its commercial use should be addressed to:*

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*Refer to NPO-43144, volume and number of this NASA Tech Briefs issue, and the page number.*

## Six-Message Electromechanical Display System

**This system would overcome the three-message limit of prior such systems.**

*Marshall Space Flight Center, Alabama*

A proposed electromechanical display system would be capable of presenting as many as six distinct messages. This system would be a more capable and more complex successor to the proposed system reported in "Four-Message Electromechanical Display System" (MFS-31368), *NASA Tech Briefs*, Vol. 24, No. 4 (April 2000), page 32. In contrast to the now-proposed six-message system and the previously proposed four-mes-

sage system, a typical conventional electromechanical display system is limited to three messages.

The three-message limit arises as follows: A typical electromechanical display system contains display elements with multiple flat faces that are rotated into view to present a message. Each display element can present, for example, an alphanumeric character or part of an image. If the display elements have flat

faces, then the number of messages is limited to three because three is the maximum number of sides of a polygon that can be placed contiguously with other, identical polygons along a common baseline and that can be rotated without interfering with an adjacent polygon.

In the proposed system (see Figure 1), each display element would include a cylinder having a regular hexagonal cross section. The adjacent

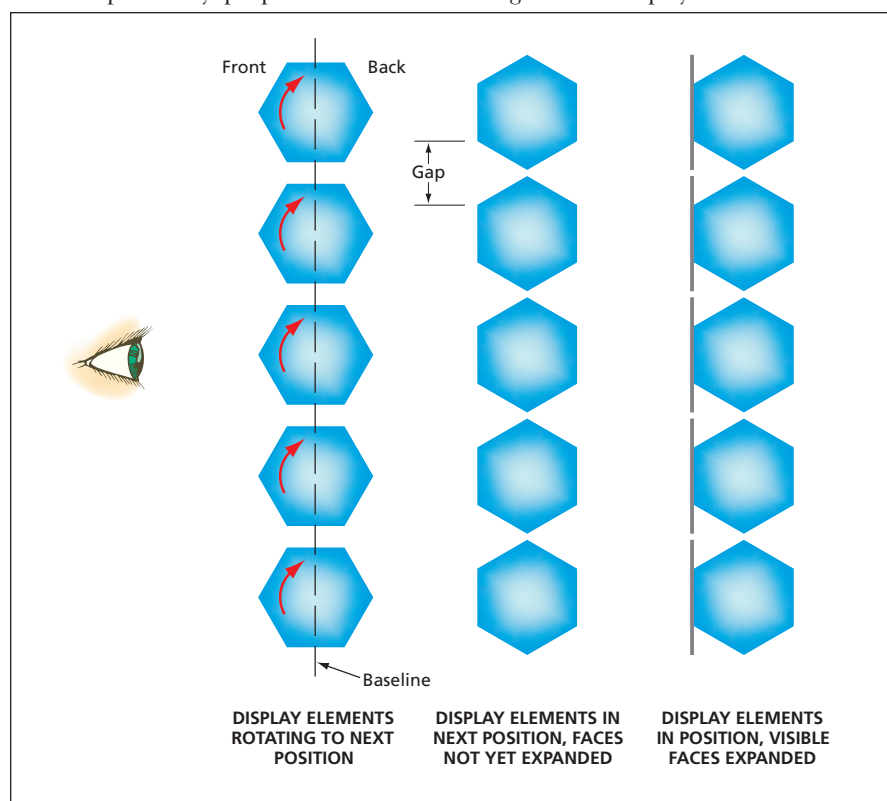


Figure 1. Adjacent Hexagonal Cylinders would be rotated to present any of six messages to viewers looking at the front side.

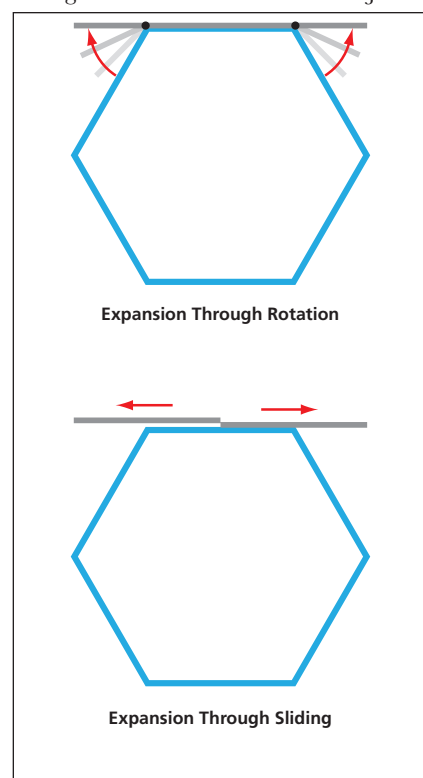


Figure 2. The Visible Face of Each Hexagonal Cylinder would effectively be expanded by rotation or sliding of panels.